mathematical modeling and parameter estimation of continuous tubular crystallizer

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Despite the many advantages of the continuous crystallization to increase consistency and flexibility of process; reduce operational variability and capital cost; and improve control of product specifications, there are few models of the system that give a reasonable description of the crystal formation kinetic. The population balance model of continuous tubular crystallizer is established to evaluate and analyze the effect of temperature trajectory through slug and insonation on the crystal size distribution. The measurement dataset extracted from a large full-factorial design of experiments is verified and compared with the predicted crystal size distribution from the discretized population balance model on the basis of first-principle kinetics whose parameters are estimated in global optimization strategy. The predicted mean crystal length and standard deviation is fairly accurate with $<20\%$ prediction error compared with the result of experiments performed at dissolution-free and low level of supersaturation environment.